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Particulate emissions to air from major incident fires

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Twenty major fire incidents across England and Wales have been of sufficient severity to require monitoring to be undertaken. Focusing on particulate emissions (PM_{10}, $PM_{2.5}$ and PM_1), measured using a laser scattering technique (OSIRIS), concentrations indicate a significant short-term contribution in excess of ambient levels. Across the twenty incidents the highest one-minute peak value for PM_{10} was 6528µg/m^3. This study is just starting to review the air quality data collected in major incidents using Air Quality Cell data. Future studies will consider how the intense emission of particulates to atmosphere impacts on ambient air quality and how the incident has affected human mortality and morbidity in the populations affected by the release using relevant health datasets such as existing syndromic surveillance datasets.

PARTICULATES AND HUMAN HEALTH:

Airborne particulates are categorised by their aerodynamic diameter such as PM_{10} for particles measuring 10µm or below or $PM_{2.5}$ at 2.5µm or below (which is itself a fraction of PM_{10}) whereby the smaller the particle size the deeper they are capable of penetrating into the lung. Such a categorisation provides no reference to their chemical or biological nature leading SNIFFER (2010) to conclude that exposure to airborne particulates has 'significant health effects […with…] no evident safe level' and advised that there is uncertainty about which compounds comprising $PM_{2.5}$ give rise to toxic affects (SNIFFER, 2010).

Major incident fires release significant levels of particulates to the atmosphere and so pose a concern for human health. With severe major incidents the Environment Agency and Public Health England establish an Air Quality Cell (AQC).

AIR QUALITY CELLS (AQCs):

In December 2005 the Buncefield Oil Storage and Transfer Depot in Hertfordshire (UK) suffered an explosion and a prolonged fire and released considerable emissions to air. In responding to this incident, it became clear that the UK did not have a timely reactive mechanism to obtain modelled and monitored air quality – a key consideration for determining short- and long-term risks to human health. Responding to the subsequent Major Incident review, DEFRA tasked the Environment Agency with delivering air quality data in the event of significant incidents. These are called Air Quality Cells. Across England and Wales, there have been 20 AQCs declared between April 2009 and December 2014.

DEPLOYMENT OF AQCs:

Across England and Wales, 20 AQCs were declared between April 2009 and December 2014, see Figure 1.

Figure 1: Location of AQCs across England and Wales

Note to Figure 1: some sites have had more than one fire but only one point is shown.

ILLUSTRATIVE RESULTS –

Location of fire: Envirotyre Limited, Littleburn Industrial Estate, Langley Moor, County Durham, DH7 8HJ
Date: 22nd April 2010 (monitoring locations identified in Figure 2)

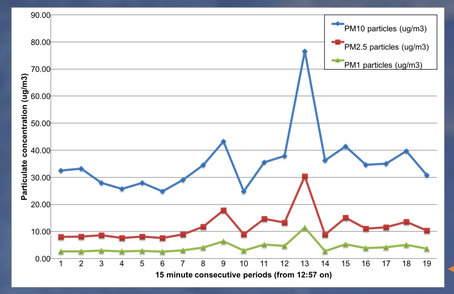


Figure 7: St. Aiden's College, Durham University (23/04/10 12:57 to 17:34)

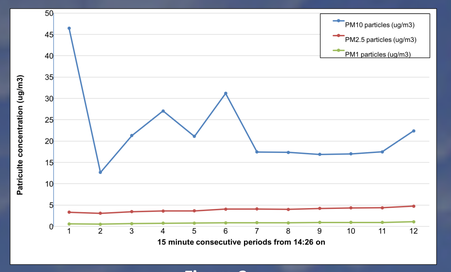


Figure 3:
Durham Girls School (22/04/10 14:26 to 16:16)

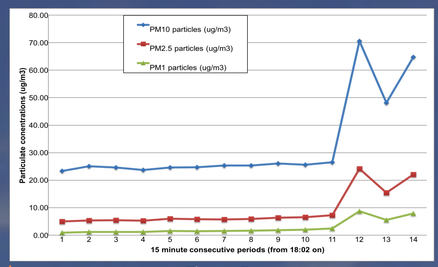


Figure 5:
Durham Girls School (22/04/10 18:02 to 21:38)

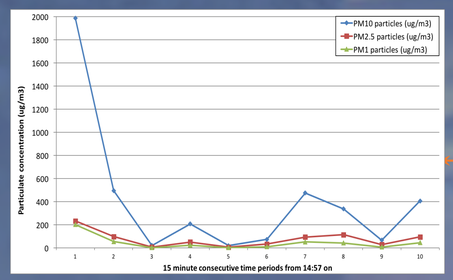


Figure 4:
Durham Golf Club (22/04/2010 14:57 to 17:29)

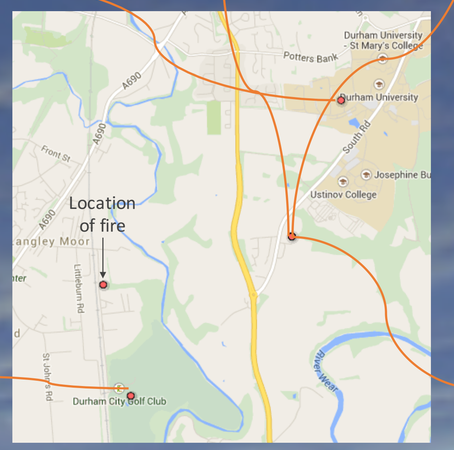
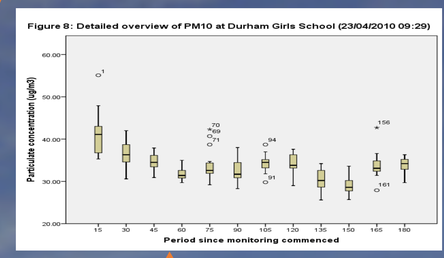


Figure 2: Map showing location of fire and location of three monitoring points



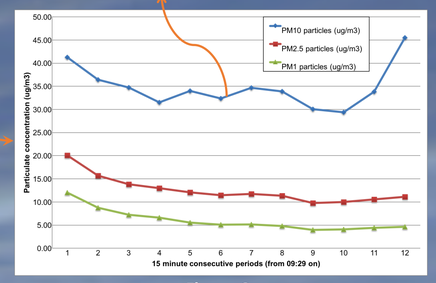


Figure 6:
Durham Girls School (23/04/10 09:29 to 12:24)

BRIEF ANALYSIS

Particulate concentrations for PM_{10}, $PM_{2.5}$ and PM_1 were measured over 1 minute periods. Figures 3 through 7 show levels on a consecutive fifteen minute basis (Nb. Periods with less than 8 minutes worth of data have been discarded). Demonstrated in these figures is the variation of concentrations, especially evident in Figures 3, 4 and 5. Figure 8 provides a descriptive interpretation of each 15 minute period for PM_{10} from one of measurement site. Evident is the wide variation in concentrations that may occur in any one period of measurement, especially with the larger sized fraction, PM_{10}.

Air Quality Data was supplied by the Environment Agency under licence. Figure 1 was generated using Google Fusion Tables. SNIFFER (2010). PM2.5 in the UK. Edinburgh, Scotland & Northern Ireland Forum for Environmental Research: 193.